

**DETENTION METERING LINE DESIGN****Culligan Truck Docks**

1. Length of Metering Line	46 ft.	Factor =	$1+K_e+29*(N^2)*L/(R^{4/3})$
2. Slope of Metering Line	3.3 %		8.18
3. Size of Metering Line	2.55 in	Pipe Area =	0.0355
4. Pipe Type and "n" Value	0.010 PE Pipe	Perimeter =	0.6676
5. Entrance Coefficient (K <sub>e</sub> )	0.5		
6. Assumed Maximum Head	5.00 ft.		
7. Hydraulic Radius (R)	0.053125	R <sup>4/3</sup> =	0.0200

Head	H x 2g	Factor	V <sup>2</sup>	V	Pipe Area	Q
5.00	322.0	8.18	39.37	6.27	0.0355	0.2225

**Q Allowable:**

$$c = 0.2 \quad Q = ciA = 0.0229$$

$$i = 2.6$$

$$A = 0.044$$

Through iterations, the allowable restrictor plate orifice size is 2.55" with a maximum head of 5'.  
If maximum head is reduced to 3', the orifice size could be 2.85".

Due to cleaning requirements, a 3" orifice will be permitted.

Storm Water Calculations					
Project: CULLIGAN WATER-TRUCK DOCK, NAPOLEON, OHIO					
TOTAL AREA Runoff flows & Coefficients, Pre & Post development					
By:RDS		Date: September 29, 2016 ~ revised Nov. 25, 2016			
<b>1) Existing (Pre-development) runoff:</b>					
	Area(Ac.)	Land use description	"C"	"I" in/hr	"Q" cfs
	0.105	Grass/Lawn Area	0.20	2.60	0.054
	0.000	Building roof	0.90	2.60	0.000
	0.000	Conc./Asph. pave.	0.90	2.60	0.000
	0.000	Gravel pavement	0.50	2.60	0.000
	0.105	Total Area	Total Existing Runoff		0.054
<b>2) Proposed (Post-development) runoff:</b>					
Project Description:					
Calculations are based on pre-development area with all grass surface and a post-development area with 886 s.f. of proposed (Future) roof area, 3,284 s.f. of conc. or asph. pavement area & 316 s.f. of graveled surface area and 103 s.f. of grassed area.					
	Area(Ac.)	Land use description	"C"	"CA"	
	0.020	Building roof (Future)	0.90	0.018	
	0.075	Conc/Asph pavement	0.90	0.068	
	0.007	Gravel pavement	0.50	0.004	
	0.002	Lawn-grassed area	0.20	0.000	
	0.105	TOTAL AREA	TOTAL	0.090	

From: Ron Sonnenberg  
1:51 PM

Check,  
I'm showing a 3" plate  
in the new basin for a pre-  
level of 0.05 s.f.  
Would like to go larger  
if we can but let us  
know,  
The original was an 8"  
unrestricted.  
Thanks!  
Ron

12-05-16 10:47 AM

n/hr	"Q" cfs
2.60	0.235
off	0.235

11 Storm = 50 Year

Storm Water Calculations							
Project: CULLIGAN WATER-TRUCK DOCK, NAPOLEON, OHIO							
AREA #3~Storm Water Detention Calculations							
By:RDS	Date: September 29, 2016 ~ revised Nov. 25, 2016						
Site Area:	0.105						
Weighted "C"	0.856						
"T"(min.)	"I"(in/hr)	"CA"	"Q" in (cfs)	"Q" out (cfs)	"Q" in-"Q" out (cfs)	Detention Volume(c.f.)	
Time of Concentration	Intensity 50 Year Storm						
20	4.80	0.0903	0.43	0.054	0.38	455	
30	3.76	0.0903	0.34	0.054	0.28	513	
40	3.06	0.0903	0.28	0.054	0.22	532	
<b>50</b>	<b>2.58</b>	<b>0.0903</b>	<b>0.23</b>	<b>0.054</b>	<b>0.18</b>	<b>535</b>	
60	2.22	0.0903	0.20	0.054	0.15	526	
70	1.97	0.0903	0.18	0.054	0.12	518	
80	1.81	0.0903	0.16	0.054	0.11	523	
90	1.68	0.0903	0.15	0.054	0.10	525	
100	1.54	0.0903	0.14	0.054	0.08	508	
110	1.46	0.0903	0.13	0.054	0.08	511	
120	1.35	0.0903	0.12	0.054	0.07	486	
130	0.00	0.0903	0.00	0.054	-0.05	-424	
140	0.00	0.0903	0.00	0.054	-0.05	-457	
150	0.00	0.0903	0.00	0.054	-0.05	-490	
160	0.00	0.0903	0.00	0.054	-0.05	-522	
170	0.00	0.0903	0.00	0.054	-0.05	-555	
180	0.00	0.0903	0.00	0.054	-0.05	-587	
190	0.00	0.0903	0.00	0.054	-0.05	-620	
200	0.00	0.0903	0.00	0.054	-0.05	-653	
210	0.00	0.0903	0.00	0.054	-0.05	-685	
220	0.00	0.0903	0.00	0.054	-0.05	-718	
230	0.00	0.0903	0.00	0.054	-0.05	-751	
240	0.00	0.0903	0.00	0.054	-0.05	-783	
250	0.00	0.0903	0.00	0.054	-0.05	-816	
260	0.00	0.0903	0.00	0.054	-0.05	-849	
270	0.00	0.0903	0.00	0.054	-0.05	-881	
<b>Minimum Detention Volume Required =</b>						<b>535</b>	Cubic Feet
		Area required for 1' depth of storage =				0.012	Acres
		Area required for 1.5' depth of storage =				0.008	Acres
		Area required for 2' depth of storage =				0.006	Acres
		Area required for 2.5' depth of storage =				0.005	Acres



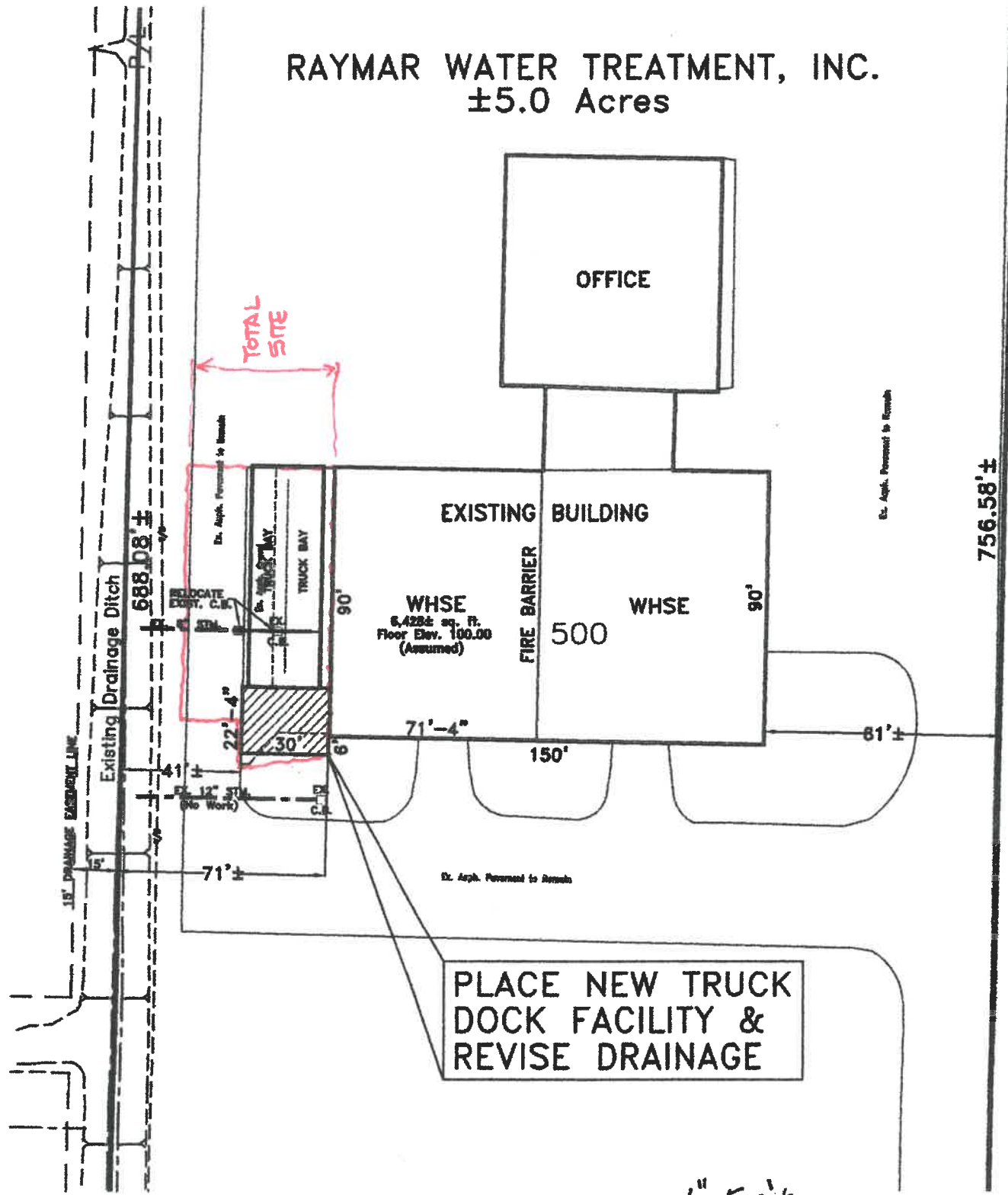


<b>Storm Water Calculations</b>					
<b>Project: CULLIGAN WATER-TRUCK DOCK, NAPOLEON, OHIO</b>					
<b>TRUCK DOCK SITE AREA~Runoff flows &amp; Coefficients, Pre &amp; Post development</b>					
By:RDS		Date: September 29, 2016 ~ revised Nov. 25, 2016			
<b>1) Existing (Pre-development) runoff:</b>					
	Area(Ac.)	Land use description	"C"	"I" in/hr	"Q" cfs
	0.063	Grass/Lawn Area	0.20	2.60	0.033
	0.000	Building roof	0.90	2.60	0.000
	0.000	Conc./Asph. pave.	0.90	2.60	0.000
	0.000	Gravel pavement	0.50	2.60	0.000
	0.063	Total Area	Total Existing Runoff		0.033
<b>2) Proposed (Post-development) runoff:</b>					
Project Description:					
Calculations are based on a pre-development area with all grass surface, and a post area development with 886 s.f. of proposed (Future) roof area, 1,714 s.f. of conc. pavement area, 214 s.f. of graveled surface and 61 s.f. of grassed area.					
	Area(Ac.)	Land use description	"C"	"CA"	
	0.020	Building roof (Future)	0.90	0.018	
	0.039	Conc/Asph pavement	0.90	0.035	
	0.005	Gravel pavement	0.50	0.002	
	0.001	Lawn-grassed area	0.20	0.000	
	<b>0.065</b>	<b>TOTAL AREA</b>	<b>TOTAL</b>	<b>0.056</b>	
	Weighted "C" = TOTAL "CA"		<b>0.056</b>		
	TOTAL "A"		<b>0.065</b>		
	Weighted "C" =		<b>0.855</b>		
<b>3) Proposed (Post-development) runoff:</b>					
	Area(Ac.)	Land use description	"C"	"I" in/hr	"Q" cfs
	0.065	See "2" Above	0.855	2.60	0.145
	Total Proposed Runoff				0.145
<b>4) Critical Storm Determination:</b>					
(0.145-0.033)/(0.033)=3.394 or 339.4% therefore :			Critical Storm = 50 Year		

<b>Storm Water Calculations</b>						
<b>Project: CULLIGAN WATER-TRUCK DOCK, NAPOLEON, OHIO</b>						
<b>TRUCK DOCK SITE AREA~Storm Water Detention Calculations</b>						
By:RDS		Date: September 29, 2016 ~ revised Nov. 25, 2016				
<b>Site Area:</b>		<b>0.065</b>				
<b>Weighted "C"</b>		<b>0.855</b>				
"T"(min.)	"I"(in/hr)	"CA"	"Q" in (cfs)	"Q" out (cfs)	"Q" in-"Q"out (cfs)	Detention Volume(c.f.)
Time of Concentration	Intensity 50 Year Storm					
20	4.80	0.0557	0.27	0.033	0.23	281
30	3.76	0.0557	0.21	0.033	0.18	318
40	3.06	0.0557	0.17	0.033	0.14	330
<b>50</b>	<b>2.58</b>	<b>0.0557</b>	<b>0.14</b>	<b>0.033</b>	<b>0.11</b>	<b>332</b>
60	2.22	0.0557	0.12	0.033	0.09	327
70	1.97	0.0557	0.11	0.033	0.08	323
80	1.81	0.0557	0.10	0.033	0.07	326
90	1.68	0.0557	0.09	0.033	0.06	328
100	1.54	0.0557	0.09	0.033	0.05	318
110	1.46	0.0557	0.08	0.033	0.05	320
120	1.25	0.0557	0.07	0.033	0.04	265
130	0.00	0.0557	0.00	0.033	-0.03	-256
140	0.00	0.0557	0.00	0.033	-0.03	-275
150	0.00	0.0557	0.00	0.033	-0.03	-295
160	0.00	0.0557	0.00	0.033	-0.03	-314
170	0.00	0.0557	0.00	0.033	-0.03	-334
180	0.00	0.0557	0.00	0.033	-0.03	-354
190	0.00	0.0557	0.00	0.033	-0.03	-373
200	0.00	0.0557	0.00	0.033	-0.03	-393
210	0.00	0.0557	0.00	0.033	-0.03	-413
220	0.00	0.0557	0.00	0.033	-0.03	-432
230	0.00	0.0557	0.00	0.033	-0.03	-452
240	0.00	0.0557	0.00	0.033	-0.03	-472
250	0.00	0.0557	0.00	0.033	-0.03	-491
260	0.00	0.0557	0.00	0.033	-0.03	-511
270	0.00	0.0557	0.00	0.033	-0.03	-531
<b>Minimum Detention Volume Required =</b>		<b>332 Cubic Feet</b>				
Area required for 1' depth of storage =		0.008 Acres				
Area required for 1.5' depth of storage =		0.005 Acres				
Area required for 2' depth of storage =		0.004 Acres				
Area required for 2.5' depth of storage =		0.003 Acres				

<b>Storm Water Calculations</b>					
<b>Project: CULLIGAN WATER-TRUCK DOCK, NAPOLEON, OHIO</b>					
<b>TRUCK DOCK SITE AREA~Proposed Drainage Area Flow Calculations</b>					
R.D.S.	Date: September 29, 2016 ~ revised Nov. 25, 2016		Critical Storm "I" in/hr=	<b>2.58</b>	
			Time of Concentration "	<b>50</b>	
<b>Area 1</b>					
Description:					
Roof & Grassed area draining over grassed area to the south to the existing C.B. and then to the west to the drainage ditch.					
	Area(Ac.)	Land use description	"C"	"I" in/hr	"Q" cfs
	0.008	Building roof (Future)	0.9	2.58	0.019
	0.000	Asph. & Conc. pavement	0.90	2.58	0.000
	0.001	Lawn-grassed area	0.20	2.58	0.001
	0.000	Reserved	0.00	2.58	0.000
	0.009		Total Flow ~ Area 1		0.019
<b>Area 2</b>					
Description:					
Balance of area draining to Existing 8" storm drain through the New on-site Trench Drain					
	Area(Ac.)	Land use description	"C"	"I" in/hr	"Q" cfs
	0.000	Building roof	0.9	2.58	0.000
	0.039	Conc. pavement	0.90	2.58	0.091
	0.005	Gravel	0.50	2.58	0.006
	0.000	Lawn-grassed area	0.20	2.58	0.000
	0.044		Total Flow ~ Area 2		0.098
<b>Maximum discharge allowable per City of Napoleon =Q2 = 0.033</b>					
<b>EXISTING STORM OUTLETS FROM PROJECT SITE AREA:</b>					
1) 12" Storm south, draining west @ +/- 0.5% approx. grade =				1.82 c.f.s.	
2) 8" Storm draining to the west @ +/- 3.3% approx. grade =				1.76 c.f.s.	
3) Reserved				0 c.f.s.	
<b>Total Estimated existing discharge capacity =</b>				<b>3.58 c.f.s.</b>	

RAYMAR WATER TREATMENT, INC.  
±5.0 Acres



1" = 50' ±



1"=10'± N

EXISTING C.I  
DRAINAGE DITCH

TOTAL SITE ~ 0.105 Ac.

AREA #3 ~ 0.097 Ac.  
TO NEW 2-2-B C.B.  
(INCLUDES AREA #2)

AREA #1 ~ 0.009 AC.  
TO EXIST. C.B.  
OVER GRASS

AREA #2 ~ 0.044 AC.  
TO NEW TRENCH DRAIN  
AREA #3

